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Aalborg d. 24. september 1999

Vedr. patentansøgning

Hermed fremsendes en patentansogning vedr. **en 3D mus**

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Kvittering for modtagelsen bedes mærket **"3D mus - II"**

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3D mouse

Modtaget PD

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Description of 3D mouse – "Drag nMouse"

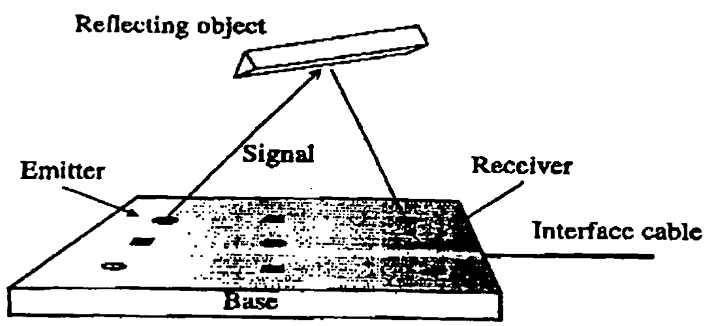
Aalborg University, September 23rd 1999
By Anders la Cour-Harbo and Jakob Stoustrup

The 3D mouse is a product that determines the three dimensional position and/or motion and/or orientation of an object by emitting electromagnetic or acoustic signals which are reflected by an object onto signal receivers. The determination of the position (and/or motion and/or orientation) of the object is based on the knowledge of the emitted and received signals. This means that the object is passive with respect to the determination of its own state. By converting the position and/or the motion of the object into three dimensional coordinates, the 3D mouse works just like a conventional 2D mouse except that three coordinates (instead of two) are available to the application to which the 3D mouse is connected. By also converting the orientation of the object into two or three angles the 3D mouse can determine directional as well as rotational motion at the same time.

The 3D mouse consists basically of two components; the base which is an active component, and the reflector which is a passive component with respect to determining position, motion, rotation. The reflector can be any object, including a finger or a hand. The base is a box in which the emitters and receivers are located. By emitting a particular and distinct pattern from each emitter it is possible to determine which part of a received signal (from any of the receivers) originates from which emitter. Thereby a number of simultaneous measurements are made. By comparing these measurements, unknown factors such as reflection characteristics of the object, noise, changes in hardware due to aging, dust and dirt, and wear and tear, can be eliminated, and thereby making it possible to determine the three dimensional position and/or motion and/or rotation of the object by appropriate algorithms (see appendix 1).

The implementation of a button-like function in the 3D mouse can be accomplished either by a distinct motion of the object, or by an actual button on the base, on the keyboard or on the reflecting object. In the latter case the result of pushing the button is a change in the state of the reflecting object indicating to the base that a button has been pushed.

The patterns in the emitted signals and the processing of the received signals are handled by a signal processor located inside the 3D mouse base.



The figure shows the principle idea of the 3D mouse. The reflecting object is exemplified by a bar.

The 3D mouse can operate in 2D mode as well. In this mode the base and the reflecting object typically will be in contact.

Appendix 1: The algorithm

The purpose of the algorithm is to convert the signals received by the receivers into a 3D position and orientation. A number of appropriate, digital signals (patterns) are available to the algorithm. These are inverse wavelet transformed and emitted. Based on the knowledge of the emitted signal the received signal is sampled and divided into blocks of certain lengths. The resulting signal is wavelet transformed and compared to the original pattern to determine how large a fraction of the received intensity originates from the emitter. This produces one number. For an ideal emitter and receiver (E/R) pair this number is a relative distance (relative to the intensities measured by other E/R pairs), but since these pairs often have characteristics deviating significantly from the ideal, a correction based on the E/R characteristic might be necessary. The relative distances determined by all the E/R pairs are combined by filtering and non-linear mappings to determine 3D position and orientation.